



PATENT  
Attorney Docket No.: COOL-01600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Thomas W. Kenny et al.

Serial No.: 10/643,684

Filed: August 18, 2003

For: **APPARATUS AND METHOD OF  
FORMING CHANNELS IN A  
HEAT-EXCHANGING DEVICE**

) Group Art Unit: 1763

) Examiner:

**TRANSMITTAL LETTER**

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Commissioner for Patents  
P.O. Box 1450  
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Sir:

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You will also find enclosed the associated Transmittals, Electronic Information Disclosure Statements, and United States Patent and Trademark Office Acknowledgment Receipts for the electronically filed Information Disclosure Statement (EFS ID #59981); (EFS ID #59982); (EFS ID #59983) and (EFS ID #59986) filed on April 28, 2004.

The Commissioner is hereby authorized to charge any additional fee or credit overpayment to our Deposit Account No. 08-1275. **An originally executed duplicate of this transmittal is enclosed for this purpose.**

Respectfully submitted,  
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Sir:

The citations listed below, copies attached, may be material to the examination of the above-identified application, and are therefore submitted in compliance with the duty of disclosure defined in 37 C.F.R. §§ 1.56 and 1.97. The Examiner is requested to make these citations of official record in this application.

United States Patents or Published Patent Applications have been filed electronically (EFS ID #59981); (EFS ID #59982); (EFS ID #59983) and (EFS ID #59986). Applicants have become aware of the following printed publication which may be material to the examination of this application:

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Respectfully submitted,  
HAVERSTOCK & OWENS LLP

Dated: 4-29-04

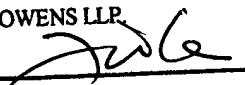
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FORM PTO-1449 (Modified) <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b> (Use Several Sheets If Necessary)			U.S. Department of Commerce Patent and Trademark Office		Attorney Docket No.: COOL-01600		Serial No.: 10/643,684	
					Applicants: Thomas W. Kenny et al.			
					Filing Date: August 18, 2003		Group Art Unit: 1763	
(37 CFR § 1.108(b))								
FOREIGN PATENTS OR PUBLISHED FOREIGN PATENT APPLICATIONS								
MAY 03 2004 PATENT & TRADEMARK OFFICE JC 69	Document Number	Publication Date	Country / Patent Office	Class	Subclass	Translation		
						Yes	No	
	97212126.9	03/04/97	CN	BO1D	61/42	X		
	AB	2000-277540	JP	H01L	21/50	X		
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AD	Kendra V. Sharp et al., "Liquid Flows in Microchannels", 2002, Vol. 6, pages 6-1 to 6-38.							
AE	Shuchi Shoji et al., "Microflow devices and systems", J. Microech. Microeng. 4 (1994), pages 157-171, printed in the U.K.							
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(37 CFR § 1.98(b))			Filing Date: August 18, 2003	Group Art Unit: 1763	
OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)					
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Examiner: \_\_\_\_\_ Date Considered: \_\_\_\_\_

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OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)					
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	EG	Chad Harris et al., <u>Design and Fabrication of a Cross Flow Micro Heat Exchanger</u> , December 2000, Journal of Microelectromechanical Systems, Vol. 9, No. 4, pages 502-508.			
Examiner:			Date Considered:		
EXAMINER: Initial citation considered. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.					

FORM PTO-1449 (Modified)			U.S. Department of Commerce Patent and Trademark Office	Attorney Docket No.: COOL-01600	Serial No.: 10/643,684
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use Several Sheets If Necessary) (37 CFR § 1.98(b))			Applicants: Thomas W. Kenny et al.		
			Filing Date: August 18, 2003	Group Art Unit: 1763	
OTHER DOCUMENTS (Including Author, Title, Date, Relevant Pages, Place of Publication)					
	EH	George M. Harpole et al., <u>MICRO-CHANNEL HEAT EXCHANGER OPTIMIZATION</u> , 1991, Seventh IEEE SEMI-THERM Symposium, pages 59-63.			
	EI	Pei-Xue Jiang et al., <u>Thermal-hydraulic performance of small scale micro-channel and porous-media heat-exchangers</u> , 2001, International Journal of Heat and Mass Transfer 44 (2001), pages 1039-1051.			
	EJ	X.N. Jiang et al., <u>Laminar Flow Through Microchannels Used for Microscale Cooling Systems</u> , 1997, IEEE/CPMT Electronic Packaging Technology Conference, pages 119-122, Singapore.			
	EK	David Bazeley Tuckerman, <u>Heat-Transfer Microstructures for Integrated Circuits</u> , February 1984, pages ii-xix, pages 1-141.			
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	EM	T.S. Raviguruajan et al., <u>Effects of Heat Flux on Two-Phase Flow characteristics of Refrigerant Flows in a Micro-Channel Heat Exchanger</u> , HTD-Vol. 329, National Heat Transfer Conference, Volume 7, ASME 1996, pages 167-178.			
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	EQ	J. Pfahler et al., <u>Liquid Transport in Micron and Submicron Channels</u> , March 1990, Sensors and Actuators, A21-A23 (1990), pages 431-434.			
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	ES	C. Perret et al., <u>Microchannel integrated heat sinks in silicon technology</u> , October 12-15, 1998, The 1998 IEEE Industry Applications Conference, pages 1051-1055.			
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	FB	Mali Mahalingam, <u>Thermal Management in Semiconductor Device Packaging</u> , 1985, Proceedings of the IEEE, Vol. 73, No. 9, September 1985, pages 1396-1404.			
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	FD	T.M. Adams et al., <u>Applicability of traditional turbulent single-phase forced convection correlations to non-circular microchannels</u> , 1999, Int. J. Heat and Transfer 42 (1999) pages 4411-4415.			
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	FF	D. Jed Harrison et al., <u>Electroosmotic Pumping Within A Chemical Sensor System Integrated on Silicon</u> , Session C9 Chemical Sensors and Systems for Liquids, June 26, 1991, pages 792-795.			
	FG	Kurt Seller et al., <u>Electroosmotic Pumping and Valveless Control of Fluid Flow within a Manifold of Capillaries on a Glass Chip</u> , 1994, Analytical Chemistry, Vol. 66, No. 20, October 15, 1994, pages 3485-3491.			
	FH	Philip H. Paul et al., <u>Electrokinetic Generation of High Pressures Using Porous Microstructures</u> , 1998, Micro-Total Analysis Systems, pages 49-52.			
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FK	M. Esashi, <u>Silicon micromachining and micromachines</u> , September 1, 1993, Wear, Vol. 168, No. 1-2, (1993), pages 181-187.			
FL	Stephanus Buttgenbach et al., <u>Microflow devices for miniaturized chemical analysis systems</u> , November 4-5, 1998, SPIE-Chemical Microsensors and Applications, Vol. 3539, pages 51-61.			
FM	Sarah Arunlanandam et al., <u>Liquid transport in rectangular microchannels by electroosmotic pumping</u> , 2000, Colloids and Surfaces A: Physicochemical and Engineering Aspects Vol. 161 (2000), pages 89-102.			
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GA	Ray Beach et al., <u>Modular Microchannel Cooled Heatsinks for High Average Power Laser Diode Arrays</u> , April 1992, IEEE Journal of Quantum Electronics, Vol. 28, No. 4, pages 966-976.			
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GG	Chun Yang et al., <u>Modeling forced liquid convection in rectangular microchannels with electrokinetic effect</u> , 1998, International Journal of Heat and Mass Transfer 41 (1998), pages 4229-4249.			
GH	Arel Weisberg et al., <u>Analysis of microchannels for integrated cooling</u> , 1992, Int. J. Heat Mass Transfer, Vol. 35, No. 10, pages 2465-2473.			
GI	Roger S. Stanley et al., <u>Two-Phase Flow in Microchannels</u> , 1997, DSE-Vol. 62/HTD-Vol. 354, MEMS, pages 143-152.			
GJ	B. X. Wang et al., <u>Experimental investigation on liquid forced-convection heat transfer through microchannels</u> , 1994, Int. J. Heat Mass Transfer, Vol. 37 Suppl. 1, pages 73-82.			
GK	Kambiz Vafai et al., <u>Analysis of two-layered micro-channel heat sink concept in electronic cooling</u> , 1999, Int. J. Heat Mass Transfer, 42 (1999), pages 2287-2297.			
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	GL	Gokturk Tune et al., <u>Heat transfer in rectangular microchannels</u> , 2002, Int. J. Heat Mass Transfer, 45 (2002), pages 765-773.		
	GM	D. B. Tuckerman et al., <u>High-Performance Heat Sinking for VLSI</u> , 1981, IEEE Electron Device Letters, Vol. EDL-2, No. 5, pages 126-129.		
	GN	<u>Bengt Sundén et al., An Overview of Fabrication Methods and Fluid Flow and Heat Transfer Characteristics of Micro Channels</u> , pages 3-23.		
	GO	David S. Shen et al., <u>Micro Heat Spreader Enhance Heat Transfer in MCMs</u> , 1995, IEEE Multi-Chip Module Conference, pages 189-194.		
	GP	S. Sasaki et al., <u>Optimal Structure for Microgrooved Cooling Fin for High-Power LSI Devices</u> , Electronic Letters, December 4, 1986, Vol 22, No. 25.		
	GQ	Vijay K. Samalam, <u>Convective Heat Transfer in Microchannels</u> , September 1989, Journal of Electronic Materials, Vol. 18, No. 5, pages 611-617.		
	GR	Sanjay K. Roy et al., <u>A Very High Heat Flux Microchannel Heat Exchanger for Cooling of Semiconductor Laser Diode Arrays</u> , 1996, IEEE Transactions on components, packaging, and manufacturing technology-part B, Vol. 19, No. 2, pages 444-451.		
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**ACKNOWLEDGEMENT RECEIPT**

Electronic Version 1.1  
Stylesheet Version v1.1.1



Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE													
Submission Type:	Information Disclosure Statement													
Application Number:	10/643684	*10/643684*												
EFS ID:	59981													
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Attorney Docket Number:														
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TRANSMITTAL		
Electronic Version v1.1 StyleSheet Version v1.1.0		
<b>APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE</b>		
Application Number:	10/643684 *10/643684*	
Date:	2003-08-18	
First Named Applicant:	Thomas Kenny	
Confirmation Number:	4600	
Attorney Docket Number:		
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**ELECTRONIC INFORMATION DISCLOSURE STATEMENT**

Electronic Version v18

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Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE
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Application Number: 10/643684 \*10/643684\*

Confirmation Number: 4600

First Named Applicant: Thomas Kenny

Attorney Docket Number:

Search string: ( 3654988 or 3817321 or 3823572 or 3923426  
or 3929154 or 4109707 or 4138996 or  
4194559 or 4248295 or 4312012 or 4450472  
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S263251 or S274920 or S308429 or S309319  
or S317805 or S325265 or S336062 or  
S380956 ).pn.

**US Patent Documents**

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

Init	Cite.No.	Patent No.	Date	Patentee	Kind	Class	Subclass
1	3654988	1972-04-11		Clayton, III			
2	3817321	1974-06-18		von Cube et al.			
3	3823572	1974-07-16		Cochran, Jr.			
4	3923426	1975-12-02		Theeuwes			
5	3929154	1975-12-30		Goodwin			
6	4109707	1978-08-29		Wilson et al.			
7	4138996	1979-02-13		Cartland			

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**Signature**

Examiner Name	Date

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4/28/2004

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Digital Certificate Holder: cn=Thomas B. Haverstock,ou=Registered Attorneys,ou=Patent  
 and Trademark Office,ou=Department of Commerce,o=U.S.  
 Government,c=US

**TRANSMITTAL**

Electronic Version v1.1  
Stylesheet Version v1.1.0

<b>Title of Invention</b>	<b>APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE</b>		
Application Number:	10/643684	* 10/643684*	
Date:	2003-08-18		
First Named Applicant:	Thomas Kenny		
Confirmation Number:	4600		
Attorney Docket Number:			
<p>I hereby certify that the use of this system is for OFFICIAL correspondence between patent applicants or their representatives and the USPTO. Fraudulent or other use besides the filing of official correspondence by authorized parties is strictly prohibited, and subject to a fine and/or imprisonment under applicable law.</p> <p>I, the undersigned, certify that I have viewed a display of document(s) being electronically submitted to the United States Patent and Trademark Office, using either the USPTO provided style sheet or software, and that this is the document(s) I intend for initiation or further prosecution of a patent application noted in the submission. This document(s) will become part of the official electronic record at the USPTO.</p>			
<b>Submitted by:</b>	<b>Elec. Sign.</b>	<b>Sign. Capacity</b>	
Thomas B. Haverstock Registered Number: 32571	/tbh/	Attorney	

<b>Documents being submitted</b>	<b>Files</b>
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	us-ids.dtd
	us-ids.xsl
<b>Comments</b>	



**ELECTRONIC INFORMATION DISCLOSURE STATEMENT**

Electronic Version v18

Stylesheet Version v18.0

Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE
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Application Number: 10/643684 \*10/643684\*

Confirmation Number: 4600

First Named Applicant: Thomas Kenny

Attorney Docket Number:

Search string: ( 5383340 or 5421943 or 5427174 or 5436793  
or 5459099 or 5508234 or 5514832 or  
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6068752 ).pn.

**US Patent Documents**

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

Init	Cite.No.	Patent No.	Date	Patentee	Kind	Class	Subclass
1	5383340	1995-01-24		Larson et al.			
2	5421943	1995-06-06		Tarn et al.			
3	5427174	1995-06-27		Lomolino et al.			
4	5436793	1995-07-25		Sanwo et al.			
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4/28/2004



8	5514906	1996-05-07	Love et al.
9	5544696	1996-08-13	Leland
10	5548605	1996-08-20	Bennett et al.
11	5575929	1996-11-19	Yu et al.
12	5579828	1996-12-03	Reed et al.
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19	5727618	1998-03-17	Mundinger et al.
20	5759014	1998-06-02	Van Lintel
21	5763951	1998-06-09	Hamilton et al.
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27	5858188	1999-01-12	Soane et al.
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43	5997713	1999-12-07	Beetz, Jr. et al.
44	5998240	1999-12-07	Hamilton et al.
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46	6010316	2000-01-04	Haller et al.
47	6013164	2000-01-11	Paul et al.
48	6019882	2000-02-01	Paul et al.
49	6054034	2000-04-25	Soane et al.
50	6068752	2000-05-30	Dubrow et al.

**Signature**

Examiner Name	Date

**UNITED STATES PATENT AND TRADEMARK OFFICE**  
**ACKNOWLEDGEMENT RECEIPT**

Electronic Version 1.1  
Stylesheet Version v1.1.1



Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE													
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First Named Applicant:	Thomas Kenny													
Attorney Docket Number:														
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Digital Certificate Holder  
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and Trademark Office,ou=Department of Commerce,o=U.S.  
Government,c=US

<b>TRANSMITTAL</b>	
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Electronic Version v1.1  
Stylesheet Version v1.1.0

<b>Title of Invention</b>	<b>APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE</b>
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Application Number: 10/643684 \* 10/643684\*

Date: 2003-08-18

First Named Applicant: Thomas Kenny

Confirmation Number: 4600  
Attorney Docket Number:

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I, the undersigned, certify that I have viewed a display of document(s) being electronically submitted to the United States Patent and Trademark Office, using either the USPTO provided style sheet or software, and that this is the document(s) I intend for initiation or further prosecution of a patent application noted in the submission. This document(s) will become part of the official electronic record at the USPTO.

Submitted by:	Elec. Sign.	Sign. Capacity
Thomas B. Haverstock Registered Number: 32571	/tbh/	Attorney

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**ELECTRONIC INFORMATION DISCLOSURE STATEMENT**

Electronic Version v18

Stylesheet Version v18.0

Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE
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Application Number: 10/643684 \*10/643684\*

Confirmation Number: 4600

First Named Applicant: Thomas Kenny

Attorney Docket Number:

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**US Patent Documents**

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

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2	6096656	2000-08-01		Matzke et al.			
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5	6119729	2000-09-19		Oberholzer et al.			
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MAY 03 2004

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47	6553253	2003-04-22	Chang	B1
48	6572749	2003-06-03	Paul et al.	B1
49	6588498	2003-07-08	Reysin et al.	B1
50	6591625	2003-07-15	Simon	B1

**Signature**

Examiner Name	Date

**UNITED STATES PATENT AND TRADEMARK OFFICE**  
**ACKNOWLEDGEMENT RECEIPT**

Electronic Version 1.1  
 Stylesheet Version v1.1.1

MAY 03 2004



Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE													
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Digital Certificate Holder  
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<b>TRANSMITTAL</b>	
Electronic Version v1.1 Stylesheet Version v1.1.0	
<b>Title of Invention</b>	<b>APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE</b>
Application Number:	10/643684 *10/643684*
Date:	2003-08-18
First Named Applicant:	Thomas Kenny
Confirmation Number:	4600
Attorney Docket Number:	

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I, the undersigned, certify that I have viewed a display of document(s) being electronically submitted to the United States Patent and Trademark Office, using either the USPTO provided style sheet or software, and that this is the document(s) I intend for initiation or further prosecution of a patent application noted in the submission. This document(s) will become part of the official electronic record at the USPTO.

Submitted by:	Elec. Sign.	Sign. Capacity
Thomas B. Haverstock Registered Number: 32571	/tbh/	Attorney

<b>Documents being submitted</b>	<b>Files</b>
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**ELECTRONIC INFORMATION DISCLOSURE STATEMENT**

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Stylesheet Version v1.8.0

Title of Invention	APPARATUS AND METHOD OF FORMING CHANNELS IN A HEAT-EXCHANGING DEVICE
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Application Number: 10/643684 \*10/643684\*

Confirmation Number: 4600

First Named Applicant: Thomas Kenny

Attorney Docket Number:

Search string: (6632655 or 20010016985 or 20010024820 or  
20010044155 or 20010045270 or  
20010046703 or 20010055714 or  
20020011330 or 20020134543).pn.**US Patent Documents**

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

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	1	6632655	2003-10-14	Mehta et al.	A1		

**US Published Applications**

Note: Applicant is not required to submit a paper copy of cited US Published Applications

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	1	20010016985	2001-08-30	Insley et al.	A1		
	2	20010024820	2001-09-27	Mastromatteo et al.	A1		
	3	20010044155	2001-11-22	Paul et al.	A1		
	4	20010045270	2001-11-29	Bhatti et al.	A1		
	5	20010046703	2001-11-29	Burns et al.	A1		
	6	20010055714	2001-12-27	Cettour-Rose et al.	A1		
	7	20020011330	2002-01-31	Insley et al.	A1		
	8	20020134543	2002-09-26	Estes et al.	A1		

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